DTE ENERGY SMART GRID WHITE PAPER

Supplemental to Testimony by
Steve Kurmas, President & COO, Detroit Edison
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Introduction

DTE's vision of the future is one where we will monitor our entire power grid in near real-time. Outages are identified and restored by a grid that corrects itself. Meters are read in time intervals of minutes, customers can review their usage on their thermostats, and have options to choose from when buying energy that varies the price of electricity depending on time of day. Some customers will allow us to adjust their thermostats and cycle their appliances when our electrical system is at peak demand. Other customers may go further by producing their own electricity with solar panels or wind turbines, store the energy with new battery technology, and charge their plug-in electric hybrid vehicles (PHEV's) in their garage for the next day's trip to work. This is the promise, and the challenge, our future represents and the Smart Grid will help us get there.

What is the Smart Grid?

The Smart Grid is an electric delivery infrastructure that integrates advances in communication, computing and electronics to meet the energy needs of the electric customers and will transform the way the energy is delivered. The smart grid is the application of digital information technology to optimize the power system with intelligent two way distributed devices for monitoring and control of the electric network from the power plant to the customer.

Through regional workshops with electric grid stakeholders the Department of Energy Office of Electricity Delivery and Energy Reliability identified seven common principal characteristics of a smart electric grid that in principal DTE Energy agrees with.

- Enable active participation by consumers

  Consumers will have visibility into prices and the ability to choose a program and a price that best suits their needs.

- Accommodate all generation and storage options

  Allow plug-and-play interconnection to practically any source of power, including renewable energy sources and storage.

- Enable new products, services and markets

  Support consistent operation from coast to coast while allowing innovation locally and regionally.

- Provide power quality for the digital economy

  Provide electricity free of sags, spikes, disturbances and interruptions. It is suitable to the data centers, computers, electronics and robotic manufacturing that will power our future economy.

- Optimize asset utilization and operate efficiently

  Allows us to put more power through existing systems, build less new infrastructure and spend less to operate and maintain the grid.

- Anticipate & respond to system disturbances (self-heal)

  A self-healing modern grid detects and responds to routine problems and quickly recovers if they occur, minimizing downtime and financial loss.

- Operate resiliently against attack and natural disaster

  Security is built in from the ground up in a modern grid.

Smart Grid Benefits

The Smart Grid is expected to perform consistent with the DOE vision in all of its various operating modes. These performance modes include:

- Emergency response – A modernized grid provides advanced analysis to predict problems before they occur and to assess problems as they develop. This allows steps to be taken to minimize impacts and to respond more effectively.

- Restoration – It can take days or weeks to return today's grid to full operation after an emergency. A modernized grid can be restored faster and at lower cost as better information, control and communications tools become available to assist operators and field personnel.

- Routine operations – With a modernized grid, operators can understand the state and trajectory of the grid, provide recommendations for secure operation, and allow appropriate controls to be initiated. They will depend on the help of advanced visualization and control tools, fast simulations and decision support capabilities. Some operations will be fully automated when decisions need to be made faster than is possible by operators.

- Optimization –A modernized grid provides advanced tools to understand conditions, evaluate options and exert a wide range of control actions to optimize grid performance from reliability, environmental, efficiency and economic perspectives. New peak-shaving and load factor-improving strategies are employed.

- System planning – Grid planners must analyze projected growth in supply and demand to guide their decisions about what to build, when to build and where to build. Modern Grid data mining and modeling will provide much more accurate information to answer those questions.

All of these benefits will be achieved through the design, manufacture, installation, operation, and maintenance of cutting edge technology that will require the hiring of hundreds of highly skilled engineers, technicians, and installers that will benefit the Michigan economy. Additionally, manufacturing opportunities and jobs may arise as technology vendors seek to expand their manufacturing capability into Michigan.

DTE's Plans for the Smart Grid

For Detroit Edison, a cornerstone of future grid modernization is the Advanced Metering Infrastructure (AMI) two-way communication that will be our enabling technology between Detroit Edison and electric loads within consumer premises. It will empower both utility and end users with information, further enabling conscious energy conservation. Detroit Edison has also recently completed an upgrade of its Energy Management System (EMS) used to remotely control the electrical system, has numerous installations of distributed generation, and is actively involved with the Department of Energy in exploring dispatchable customer generation, smart energy distribution devices, energy storage, and plug-in hybrid electric vehicles (PHEV) that are all part what will become our Smart Grid.

Advanced Metering

DTE Energy has been an innovator in the application of advanced metering technologies for many years. Through the years, our capabilities to collect and manage customer meter data have significantly changed. This evolution of technology has grown from advancements in manual meter reading handheld equipment to radio controlled data collection for hard to access locations to the automatic collection of meter data through fixed communication networks. The progression of DTE Energy into Advanced Metering Infrastructure (AMI) opens the door to even more services that will provide significant customer value and enable business processes across our entire enterprise.

DTE Energy plans to install a comprehensive and highly flexible AMI system. The AMI system will provide bi-directional communication with every consumer's meter for advanced data collection and load control. Every electric meter will have the capability to communicate with other load control and communication devices within the customers premise or on the distribution network. The AMI system will serve as a foundational component for the Smart Grid at DTE Energy. The DTE Energy AMI system is much more than just a meter reading system, it is a two-way meter communication system that enables:

- Meter reading
- Outage monitoring and response
- Power quality monitoring
- Remote disconnect / reconnect
- System load management
- Distribution asset optimization and design

DTE Energy is in its first phase of automating 10,000 metering points with AMI. Approximately 8500 electric and gas meters have been automated within the DTE Energy territory in Grosse Ile, MI. After extensive testing has been successfully completed and executive approvals are obtained in mid year 2009, DTE Energy will commence installing another 20,000 electric meters and gas modules. Upon completion of the 20,000 endpoints and executive approvals, DTE Energy will proceed with full AMI automation of its entire service territory covering 2.7 million electric and 1.3 million gas meters.

DTE Energy has selected Itron Inc. as their technology partner for implementing the AMI system. Itron is a market leader in utility metering and advanced metering solutions. DTE Energy is not alone in their selection of Itron's OpenWay system. Other industry leading utilities such as Southern California Edison, San Diego Gas & Electric and CenterPoint Energy in Texas have also chosen the OpenWay system as their AMI platform.

Itron's AMI product, OpenWay, is an open standards system that adheres to industry-driven ANSI C12.19, C12.22 and Zigbee application protocol standards. The OpenWay system will also be integrated with additional components from Comverge, a leading a leading demand response company and SmartSynch, a leading digital cellular and Wi-Fi meter communications technology provider.

All AMI meters with be fully compliant with the features necessary to classify them as "smart" meters including:

- 2-way communication utilizing ANSI C12.22 protocol
- Advanced interval recording capability
- Remote disconnect/reconnect service switch capability
- Outage detection when the meter loses power, and when power is restored
- Transmit on-demand and scheduled readings of kWhr usage and voltage
- 2-way communications with in-home devices such as smart thermostats, digital load controls and in-home displays
- Remote meter firmware and configuration programming
- Bi-directional and net metering capability
- Time-of-use energy recording
- Capable of storing at least 45 days of interval and register metering data
- Advanced tamper detection and alarms

The OpenWay system being implemented at DTE Energy is comprised of three network data transport layers. These layers are comprised of a Wide Area Network (WAN) or backhaul, a Local Area Network (LAN), and a Home Area Network (HAN). This "wide open" architecture provides DTE Energy with the flexibility to interface with other systems and devices utilizing industry standard application protocols standards. The system also allows DTE Energy the complete freedom to choose communication technology and hardware providers.

The OpenWay system is monitored and controlled by a Master Station software system called the OpenWay Collection Engine (CE). The CE is highly tuned for network management and reliability and is designed for large deployments of up to 10 million meters per system. It works collaboratively with a Meter Data Management System (MDM), where meter data is stored and reading schedules are initiated, to deliver the required functionality. DTE Energy has installed a foundational MDM system and is currently building out the necessary services across the entire enterprise to leverage AMI functionality and data.

The OpenWay WAN serves as a data transport layer from internet protocol (IP) take out points called Cell Relays in the field directly to the CE. The WAN utilizes multiple communications media options including GPRS/CDMA cellular, private radio, WiFi, or WiMax. Each Cell Relay is packaged into a customer meter with a slightly higher profile and acts as a communications router serving up to 1000 electric meters in the general vicinity.

The OpenWay LAN operates as an adaptive tree network utilizing a highly optimized, 900 MHz unlicensed radio built into every customer electric meter. This adaptive tree network operates like a mesh and self forms and adapts to changing field conditions. Each meter has the freedom to communicate through other meters in the network and does not require a point to pint connection to a Cell Relay. The OpenWay LAN provides highly robust connectivity with a high degree of link margin in the design which enables high network reliability and availability. \

The OpenWay HAN provides for communications from each customer meter to in-home controls, widening the availability of Demand Response participants to potentially every home, thereby delivering the true benefit of energy conservation. Each electric meter contains a 2.4 GHz Zigbee radio which allows the flexibility to communicate with thermostats, energy monitors, and other digital load control devices. The Zigbee radio also has the capability to collect meter data from gas and water meters. DTE

Energy will be utilizing this function to collect gas meter data from its Michcon gas meters in areas of overlap with electric service.

The DTE Energy AMI technology will be utilized for energy management and demand response. Implementing AMI will allow DTE Energy to assess quantitative impacts, technical feasibility, operational aspects, and customer benefits. Initially, DTE Energy plans to run a demonstration pilot program which will cover the following areas:

- Load monitoring
- Load control event notification
- Thermostat control and display
- Text messages
- In-home display with remote control (separate from thermostat)
- Air-conditioning load control
- Water heater load control
- Plug-in modules for small appliance loads
- Web interface to customer

One challenge that DTE Energy and the utility industry in general faces is the technical maturity and commercial availability of devices to serve these functions. Multiple vendor technology solutions will be required to meet the future needs of DTE Energy customers. Based on a limited review of the marketplace and technology solutions, there is no single solution that provides all the features listed above. Commercially available products to cover these features are very limited and involve some degree of risk due to complicated technology with minimal interoperability. Common communication standards are slowly evolving and being led by utilities and equipment manufacturers during projects such as outlined here.

DTE Energy envisions offering energy management and demand response customer options focused on presenting customers with several potential service offerings that leverage AMI. This new generation of behind-the-meter technologies supported by AMI can promote changes in customer usage behavior. DTE Energy intends to test the value and cost effectiveness of AMI, smart thermostats and home networks when used in conjunction with time-of-use (TOU) and critical-period-pricing (CPP) rates to change customer behavior in response to demand response signals. DTE Energy will also test the effect and changes in customer behavior resulting from customer education. DTE Energy will be able to calculate changes in customer load research statistics as a function of the TOU and CPP rate changes.

AMI will enable the demonstration of pilot offerings for both residential and commercial customers. These pilots and potentially future services are designed to test and demonstrate the use of the new technology, the effect of new rate designs and the impact of education on customer demand response and energy conservation behavior. The five pilot offerings enabled by AMI are:

1. Energy Monitor with Education

   This pilot will provide customers with an in-home, AMI-enabled energy display or internet portal to actively monitor their energy usage. Customers will receive education on how they can benefit by modifying their energy usage behavior and on methods to manage the times their usage takes place.

2. Base Time-of-Use

   This pilot offers customers a multi-tiered time-of-use pricing option based on time of day and season of the year. This demonstration pilot is the base case scenario as customers will simply be offered tariff based pricing with significant differentials between on-peak period, shoulder periods and off-peak periods similar to actual market based pricing. Customers will be provided with an AMI–enabled smart programmable thermostat to assist in managing usage according to time of day. This demonstration pilot will test new pricing strategies and the effect of changing customer-use behavior.

3. Time-of-Use with Education

   This demonstration pilot is identical to the Base Time-of-Use pilot, except customers will also receive education on how they can benefit by modifying their usage behavior and on methods to manage the times their usage takes place. Education will include the proper use of programmable thermostats, and ways to manage laundry and other household or business activities to take advantage of lower price periods. It is anticipated that comparisons between this demonstration pilot and the Base Time-of-Use demonstration pilot will measure the impact of customer education.

4. Critical-Period Pricing (CPP)–Passive Demand Response

   In addition to Time-of-Use pricing, customers in this demonstration pilot will receive CPP signals. CPP signals will notify customers in advance that extreme real-time prices are anticipated or that a critical load day is expected. Notification to customers is anticipated to be via AMI enabled smart thermostat technology, e-mail, internet or phone messages one day in advance. Customers will be provided with the expected real-time price that they will pay for use during the critical period if they do not reduce demand during the critical period. Additionally, customers will be offered a reduced price/kwh for the same period if they reduce demand. If technology permits, price per kwh for all time-of-use periods will be provided real time to customers either via an Internet site or smart thermostat display. Customers enrolled in this demonstration pilot will receive smart

programmable thermostats along with education on product use, pricing impacts and usage management. This demonstration pilot is intended to measure changes in customer behavior to critical period pricing with education on household or business management of usage in conjunction with time-of-use and price signaling.

5. Critical-Period Pricing (CPP)with Direct Load Control

This demonstration pilot will offer the same program as the CPP–Passive program with the exception of direct load control by the utility of the customer's central air conditioner, pool pump or hot water heater. During critical peak periods, by utilizing an AMI enabled thermostat or digital control, the utility will control the duty cycle or run time of the controlled load. At the conclusion of the critical peak period, the load will be returned to its original setting. Key measurements of this demonstration pilot will be the actual load reduction achieved through direct load control and whether the load reduction is significantly greater than the CPP-Passive demonstration pilot.

Benefits of AMI

The new AMI meters are complex digital devices, essentially computers under the glass. Inherent to the new technology, they are extremely accurate when compared to our old electromechanical meters. The AMI meters will begin recording energy usage at a level that cannot even be detected by traditional electromechanical meters.

Meter Readings are currently collected by field personnel that visit each customer location once per month to visually or electronically read the meter. About 15% of our electric and 35% of our gas meters are inside of buildings often making the obtaining of reads difficult at best. DTE Energy has gas meters that are read via a remote Hexagram wand system that has essentially reached its end of life making access an issue. AMI will eliminate the need and cost of maintaining this obsolete system.

The AMI system is capable of collecting monthly billing reads 99% of the time, in the normal 3 day billing window and daily reads at a 95% success. This is just what has happened in our initial pilot area last month. The AMI system obtained 99.7% of the billing reads in a time when the weather was extremely cold and snowy. Our own readers, who really do a good job, could only obtain about 92% of these reads this January. In the past these would have been estimated bills, today they are actual. in the future personnel will no longer have to visit customer homes thereby eliminating these customer access issues. Realize, that these actual read benefits transcend throughout our customer service and the enterprise as I will show you

The automation of meter reading through AMI will provide a greater resolution and accuracy of meter data. This will reduce the number of escalated customer complaints handled by the Consumer Affairs area. AMI will provide daily and hourly meter readings which will also provide customer representatives with the information for quicker resolution of normal customer billing inquiries. AMI will increase the reliability of securing a monthly billing read and thus reduce the number of consecutive estimates. Other utilities that have installed automated meter reading systems have seen a significant reduction in escalated customer complaints and consecutive estimate complaints.

The ability of the AMI system to perform reads on a daily basis will eliminate the need to calculate readings for customers moving in or out.

Some customers own multiple homes and receive multiple bills with different due dates. With AMI, the potential exists for the customer to have all his meters read on the same day regardless of their location. This will allow the customer customize their bill payment period or use a single period of payment each month.

Timely and accurate meter readings will result in fewer customer phone calls to resolve billing inquiries. Call handling time will also be reduced because the DTE Energy customer representatives will have daily and hourly online meter data to resolve customer inquiries. Should it be necessary, the AMI system also provides the capability to deliver on-demand reading to the Customer representative desktop while on the phone with the customer. This feature may not be required as the customer will have daily actual reads that they have never had before.

In addition to reading each meter once per month, special meter readings are requested off-cycle to resolve billing complaints and customer special requests. These requests will be significantly reduced and essentially eliminated because daily and hourly customer meter data will be available for each meter location. In the event that a special read is necessary, the AMI system will be capable of scheduling and retrieving on-demand meter readings immediately or on a scheduled basis.

AMI will allow Detroit Edison Call Center Operators and Dispatchers to verify that a customer meter is correctly powered before sending a crew to the site. The AMI system will reduce the number of outages submitted by customers that are OK on arrival when a Detroit Edison crew visits the site during the restoration from non-storm and storm events.

During storms today, we call customers to verify that their power on or has been restored. AMI will allow Detroit Edison to remotely verify that an individual customer meter does or does not have power. With AMI, we can eliminate the need to call and interrupt the customer again by pinging the meters once the crews report they have completed a restoration.

During storm related outage events, electric distribution crews restore distribution circuit segments according to instructions from dispatchers using the outage analysis system. The outage analysis system knows which meters are out of service by correlating phone calls from customers to the distribution circuit. Although, not every customer calls when power fails. Sometimes crews restore a circuit segment and are dispatched to a new location without realizing that not all customers were restored. When Detroit Edison is notified that additional customers are still out of service in the restored area, a field service or distribution crew must return to the site to restore the remaining customers. This results in additional crew time for restoration. The AMI system will be able to verify that any meter does (or does not) have power by pinging the meter when a dispatch operator requests such information.

AMI electronic meter failure modes are more easily identified than traditional induction meters both because of their communication capability and the fact that their typical failure mode is to stop functioning rather than drifting in accuracy, as induction meters do. AMI will allow a much quicker identification and resolution of meter malfunction or failure.

When power problems occur, customers contact DTE Energy with low voltage complaints that require investigation by field personnel. The AMI system will provide time stamped information on supply voltage at customer meters, reducing the need for field investigations.

AMI will provided hourly load data for the quick resolution of customer transformer overload conditions on a preventative basis. Work orders may be placed to replace equipment on a scheduled rather than an emergency basis, and this will avoid the associated damage and clean-up efforts.

With the AMI disconnect/reconnect service capability, meters can be disconnected and reconnected immediately. Crews do not need to visit the site to do either the disconnect or restoration.

Gas and electric energy theft is a huge problem at DTE Energy. The AMI system will provide us with alarms that tell if a meter has been tampered with. AMI will not prevent the theft but it will tell us where and when a theft event has occurred

With AMI, we will be able to optionally control the customers' thermostat. This will allow DTE Energy to prevent overloading conditions during high temperature demand periods. But this also has other benefits for the customer. Imagine the customer is on vacation out of state or even out of the country, they will be able to log on thru the internet to their home thermostat and command it to set the temperature you desired upon returning home.

Another benefit for the customer is that they will have online access to their data. Customer will be able to logon on to the internet and see their daily and even hourly energy usage. This will allow customers to better manage their own power usage

Advanced Distribution Automation

Advanced Distribution Automation is the expansion of our Supervisory Control and Data Acquisition System (SCADA) into the distribution system downstream of our substations, giving us specific control of circuit segments between our substations and our customers. Implementation will require significantly enhanced information on the type and location of our physical assets including detailed equipment sizing and specifications, construction details, and phasing. With that information, a mathematical model of the electrical system will be built from which we may predict the location of electrical faults within a few hundred feet of their actual location. Repair crews can be dispatched directly to the trouble location without the time delay of patrolling the circuit to find the problem. Longer term, restoration scenarios will be developed and programmed into the system to perform restoration switching automatically while repair crews are in transit. This will minimize the number of customers experiencing an outage even further as we mobilize to repair.

Dispatchable Customer Generation (DCG) Program

Detroit Edison's Dispatchable Customer Generation (DCG) program utilizes diesel fueled 1 MW and larger customer-owned generation as an additional resource to serve peak demands.

DCG is a mutually beneficial partnership between Detroit Edison and our customers who own on-site generation. In exchange for allowing Detroit Edison dispatch rights to our customer's generator, customers benefit from Detroit Edison providing all fuel, maintenance and repair for the generator. Detroit Edison also provides all necessary switchgear for new or existing generators. Detroit Edison benefits by dispatching capacity resources currently located on its system or soon to be added to its system.

The customer's generator is always available to backup of their facility and will operate synchronized and in parallel with Detroit Edison so there is no service interruption.

Customer Benefits:

- Potential annual savings range from $10 – $12,000 in electrical and maintenance costs. Based on manufacturers' recommended maintenance schedule.
- Improved equipment reliability
- 24-hour power and health monitoring
- No fuel cost or scheduling
- No maintenance cost or scheduling
- Relief of direct equipment failure
- Monthly full load testing

Program Specifics:

1. Detroit Edison dispatch capability:
    - Detroit Edison will have dispatch rights to the customer's generator up to 250 hours per year to meet peak power requirements.
    - Using Detroit Edison's Distributed Resources System Operations Center (DR-SOC), a Detroit Edison dispatcher can remotely start and monitor the customer's generator.
2. Fuel:

- Detroit Edison will pay all fuel costs, including fuel utilized for testing, standby and dispatch.
- DR-SOC will monitor fuel levels and dispatch fuel delivery.

3. Operations and Maintenance (O&M): Detroit Edison assumes all O&M costs for the customer's generation. This includes, but is not limited to, the following:
    - Normal maintenance
    - Summer peak inspection
    - Repair or replace service for mechanical failures
    - Other O&M including coolant, coolant heaters, belts and batteries.
4. Monitoring: Detroit Edison provides 24-hour monitoring through DR-SOC.
    - 24x7 monitoring of customer's on-site generation
    - Power quality
    - Real-time health
    - Generator alarm monitoring
    - Utility monitoring
5. Switchgear/ Controls: Detroit Edison will pay the cost to provide or upgrade switchgear and install control and communications hardware at no charge, increasing reliability and improving control of the customer's system.
    - All DCG customers would have capability to operate as follows: normal, export or standby.
    - If necessary, Detroit Edison will pay the cost to upgrade to paralleling capability.
    - If necessary, Detroit Edison will pay the cost to upgrade generator control.
    - Detroit Edison provides protective relaying to allow for export capability.
    - Switchgear maintenance provided by Detroit Edison.
6. Rates: The DCG customer benefits by paying standard electric rates for power used, regardless of where it's being generated.

Energy Storage

DTE Energy is supporting A123 Systems on a Low Cost Lithium Ion Battery for Solar Power Storage grant from the Michigan Public Service Commission. The objective is to develop an advanced lithium ion battery that approaches the lifecycle cost of a lead acid battery for solar power energy storage applications. Reliable residential scale distributed and dispatchable energy storage is needed and the superior performance characteristics of lithium ion batteries make them an attractive solution if the cost

can be reduced. Lower cost battery solutions can be part of residential and commercial sector peak-load shifting applications. The benefit to Michigan and the nation would be enormous by helping meet grid reliability, shifting peak loads, and in improving the asset utilization of grid infrastructure.

DTE Energy will provide performance, safety, life and cost specifications for distributed energy storage systems that may be adopted by DTE Energy customers. Since these specifications will be at the system level, DTE Energy will work with A123Systems' engineers to break these costs down to battery pack level, and the pack level criteria will be used to guide process and materials selections. In turn, A123System's engineers will perform bottom-up designs and trades analyses on battery architectures and review these with DTE at periodic program reviews.

Plug-in Hybrid Electric Vehicle

DTE Energy, in collaboration with its partners, General Motors (GM) and the University of Michigan, is conducting a Plug-in Hybrid Electric Vehicle (PHEV) Pilot project funded by the Michigan Public Service Commission. By providing a cost-effective, practical solution that substantially improves automotive fuel economy and emissions without the limited range of a pure electric vehicle, PHEVs have the potential to simultaneously redefine the vehicle and transform our use of the electric utility system. Unlike other alternative vehicle technologies, PHEVs do not require massive upfront infrastructure investments because the existing electric infrastructure can likely be made to support relatively quick adoption. As a new source of electric demand with the ability to store electrical energy, PHEVs create a number of opportunities and potential impacts for the electric utility system that can be addressed with smart grid technologies to help manage the additional demands placed on the electric grid. As one of the leaders in PHEV-related thought and innovation in the electric utility industry, DTE Energy has assembled a team that is uniquely positioned to utilize the PHEV Pilot Grant to advance the goal of making Michigan the center of PHEV-related business and innovation. The main goals of the project are to bolster economic development in Michigan via local PHEV industry development, assess the environmental impacts of PHEVs, and understand how the widespread adoption of PHEV impacts both Detroit Edison and the broader Michigan/MISO electric system.

Smart Devices

Detroit Edison is a member of the Advance Grid Applications Consortium (GridApp) which is a consortium of utilities that join together to help modernize the U. S. electrical grid. GridApp provides a fast-track process for engineering development, demonstration, and validation of selected high-impact technologies. Devices Detroit Edison is testing include:

-S&C Trip Saver one shot recloser in a cutout fuse holder, minimizing outages due to tree contact

-GridSense Line Tracker communicating meter load and fault current

-Cooper Triple Single reclosers allowing a single phase to be opened, minimizing customers affected

Obstacles to Implementation

Many of the resources necessary for Smart Grid are in addition to those already allocated to important initiatives like wind power, solar power, nuclear power, and environmental. Adding Smart Grid investment on top of his may create rate burdens our customers will find hard to pay. Rapidly changing technology presents an additional challenge as generations of equipment become obsolete in as little as 5-10 years and need to be replaced. Pacing the timing and extent of our investments to maximize the benefit to our customers and the Michigan economy will be imperative.